REMARKS

Claims 1, 4-10: 35 U.S.C. § 103(a) - Tsuya-Okase

Claims 1 and 4-10 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Tokai et al. (US 6,566,199) in view of Okase (US 5,749,723).

Claim 1

Claim 1 is amended to show that the layer to be oxidized is a layer of a vertical cavity surface emitting laser (VCSEL). Claim 1 further includes the feature of "the layer which is to be oxidized, as the oxidation time continues, being oxidized ever further from an edge into the layer stack under the influence of the oxidation gas at the process temperature." This feature applies to a VCSEL, but is not taught or suggested as applying to the memory transistor of Tokai.

In neither Tokai nor Okase, whether considered alone or in combination, does oxidation occur from an edge into the layer stack in a VCSEL. The conditions for forming a nonvolatile memory as shown in Tokai (Figures 14A to 14E) are different from the conditions for forming an aperture for a VCSEL. In Tokai, for example, oxidation occurs from the bottom to top (see layers 82, 83, 84, and 85 of Figures 14A to 14E of Tokai) in a memory device. Neither does the oxidation in Okase occur from an edge of a layer stack.

The Office Action relied upon the Tsuya reference to disclose a laser unit with respect to claim 12 (see page 5 of the office action). According to claim 12 (and now according to claim 1), however, the layer to be oxidized is used in an electronic component that is an integrated vertical laser unit. The layer to be oxidized in Tsuya was not used in the laser unit disclosed in Tsuya. As noted, claim 1 is amended to clarify that the layer to be oxidized is of a vertical cavity surface emitting laser and is oxidized from an edge, which is not disclosed in any of the sited references.

Claim 1 relates to oxidation for a VCSEL according to rapid thermal processing, in contrast to using a furnace or oven (specification, page 5, lines 1-5). By way of the claimed method it is possible to have a higher heating rate in rapid thermal processing. In addition, if a furnace is used the edge of the layer to be oxidized is covered during ramp up with an oxide that reduces the oxidation rate at the inner part of the layer at the

processing temperature. In other words, if the processing temperature is reached very fast, as with the claimed method, no such detrimental oxide is formed and oxidation rate at the process temperature is high.

Claim 1 is also amended to show that the process temperature is recorded by recording the temperature of the holding device, the process temperature being the temperature of the holding device of the substrate. The Office Action asserts that the wafer holder 81 of Okase discloses the claimed holding device. The wafer holder 81 of Okase, however, does not teach recording a temperature of the holding device, where the process temperature during the processing being the temperature of the holding device or of the substrate. The process temperature in Okase is recorded as the temperature of the atmosphere within a reaction tube 1 (Okase, col. 4, lines 1-13). Accordingly, the Tokai-Okase combination does not disclose all the features of claim 1 and the claims that depend from claim 1.

Claim 4

The Applicant respectfully reiterates its position that the Tokai-Okase combination does not disclose the features of claim 4. In Okase, the temperature at which oxidation occurs is between 800°C and 1200°C (Okase, col. 4, lines 1-16). In particular, in Okase the wafer boat is introduced into the reaction tube *after* the atmosphere in the reaction tube is heated up to e.g., 800°C (Okase, col. 4, lines 1-3). Once the wafer boat is introduced, the interior of the reaction tube is then heated up to e.g., 1200°C (Okase, col. 4, lines 3-4).

According to claim 4, the process temperature is the temperature at which the layer is oxidized and is between 350°C and 450°C. The process temperature at which the layer is oxidized in Okase is not between 350°C and 450°C. As noted, the wafer boat is not introduced into the reaction tube until after the atmosphere of the reaction tube has been heated to 800°C. In Tokai, the film-forming temperature is between 800°C and 1100°C (See Tokai, col. 12, lines 5-7; col. 22, lines 33-34; Figs. 5-9). Accordingly, the Tokai-Okase combination does not teach a process temperature of between 350°C and 450°C.

Claim 5

The Applicant respectfully reiterates its position that the Tokai-Okase combination does not disclose the features of claim 5. Claim 5 includes, *inter alia*, a preheating step in which the temperature in the heating device is held, for at least ten seconds, at a preheating temperature that is lower than the process temperature and higher than a condensation temperature of the oxidation gas, and where the oxidation gas begins to be admitted to the heating device before the preheating temperature is reached or at the preheating temperature. The office action points to col. 3, lines 66-67 through col. 4, lines 1-42 to disclose these features. In Okase, the atmosphere of the reaction tube is heated to 800°C, the a wafer boat 5 is loaded into the reaction tube, the atmosphere of the reaction tube is heated to 1200°C, and then oxidation gas is introduced (Okase, col. 4, lines 1-7).

There is no disclosure in either Tokai or Okase directed to holding the temperature in the heating device for any duration of time, *let alone for at least ten seconds*. Neither is there a disclosure in either Tokai or Okase of beginning to introduce the oxidation gas on or before the preheating temperature is reached. In Okase the oxidation gas is not introduced until the 1200°C temperature is reached (Okase, col. 4, lines 3-6). If the 1200°C is relied upon to disclose the preheating temperature, then Okase does not disclose a processing temperature which, according to claim 5, is higher than the preheating temperature. In addition, there is no disclosure in either Tokai or Okase of using a preheating temperature that is higher than the condensation temperature of the oxidation gas used. Accordingly, the Tokai-Okase combination does not teach or suggest the preheating features as claimed in claim 5.

Claim 9

The Applicant respectfully reiterates its position that Tokai does not disclose the features of claim 9. Claim 9 includes, *inter alia*, interrupting oxidation before a desired oxidation width is reached, recording the oxidation width, and performing post-oxidation of the layer as a function of the recorded oxidation width. These features allow accurate determination of parameters that are relevant for oxidation, such as the metal content of the layer or the actual starting size of the diaphragm to be produced, which may be used to adjust the process time for subsequent oxidation of the same oxide layer. This

can provide increased accuracy in achieving the desired oxidation width (See Specification, p. 7, lines 17-30). The office action refers to Figure 1 of Tokai to disclose the features of claim 9. Neither Figure 1 nor the disclosure of Tokai disclose or suggest interrupting oxidation before a desired oxidation width is reached, recording the oxidation width, and performing post-oxidation as a function of the recorded oxidation width. The addition of Okase does not cure this deficiency. Okase does not disclose interrupting oxidation before a desired oxidation width is reached, recording the oxidation width, and performing post-oxidation as a function of the recorded oxidation width. The Tokai-Okase combination does not disclose the features of claim 9.

For the foregoing reasons, the Applicant respectfully submits that claims 1 and 4-10 are not unpatentable over Tokai in view of Okase and thus requests withdrawal of the rejection of these claims under § 103(a).

Claims 2, 11, 12: 35 U.S.C. § 103(a) – Tokai-Okase-Tsuya

Claims 2, 11, and 12 are rejected as being unpatentable over Tokai and Okase in view of Tsuya (US 4,525,223).

The Applicant respectfully traverses the rejection of claims 2, 11, and 12. Claims 2, 11, and 12 each depend from claim 1. As asserted above, the Tokai-Okase combination does not disclose all the features of claim 1. The Tokai-Okase combination does not disclose recording a temperature of the holding device, where the process temperature during the processing being the temperature of the holding device or of the substrate. The addition of Tsuya does not cure this deficiency. The office action relies on Tsuya to disclose a gallium arsenide substrate, a holding device containing graphite, a thermocouple, and a laser unit. Accordingly, claims 2, 11, and 12 are not unpatentable over Tokai and Okase in view of Tsuya at least for the reasons stated above with respect to claim 1.

With respect to claim 11, the office action relies on Tsuya to disclose a thermocouple. According the claim 11, the temperature *of the holding device* is recorded using a pyrometer or using at least one thermocouple. For the reasons noted

above, neither Tsuya, nor the combination of the Tokai, Okase, and/or Tsuya, disclose recording the temperature of the holding device.

For the foregoing reasons, claims 2, 11, and 12 are not unpatentable over Tokai and Okase in view of Tsuya. Accordingly, the Applicant respectfully requests withdrawal of the rejection under § 103(a).

Claims 18-20: 35 U.S.C. § 103(a) – Tokai-Okase-Weaver

Claims 18-20 are rejected as being unpatentable over Tokai and Okase in view of Weaver (US 5,411,763).

The Applicant cancels claim 18. Claim 19 is amended to show that the holding device comprises a graphite box and a graphite cover, where introducing the substrate which bears the layer stack into the holding device comprises placing the substrate in the graphite box and covering the graphite box with the graphite cover. The Weaver reference does not disclose the features of claim 19, as amended. Claim 20 depends from claim 19 and is amended to show that the graphite box comprises at least ninety-percent graphite.

Further, and as asserted above, the Tokai-Okase combination does not disclose recording a temperature of the holding device, where the process temperature during the processing being the temperature of the holding device or of the substrate. The addition of Weaver does not cure this deficiency. The office action relies on Weaver to disclose a gallium arsenide substrate, a holding device containing graphite, a thermocouple, and a laser unit.

Accordingly, claims 19-20 are not unpatentable over Tokai and Okase in view of Weaver at least for the reasons stated above with respect to claim 1 and the Applicant respectfully requests withdrawal of the rejection under § 103(a).

Claims 21-22 and New Claim 23

The Applicant gratefully acknowledges the Examiner's finding that claims 21-22 are allowed over the prior art. The Applicant adds new claim 23 that depends from claim 21. Claim 23 shows that the second process time is approximately 350 seconds. Support for this feature may be found in the Specification at least on page 19, lines 13-16. Applicant respectfully submits that claim 23 is also allowable over the prior art.

Conclusion

The Applicant amends claims 1, 12, and 19-20, cancels claim 18, and adds new claim 23. The Applicant respectfully submits that the pending claims are in condition for allowance. The Examiner is respectfully requested to contact the undersigned in the event that a telephone interview would expedite consideration of the application.

Respectfully submitted,

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